ENVIRONMENTAL ASSESSMENT OF THE OPERATION AND MAINTENANCE OF

BALL MOUNTAIN LAKE

WEST RIVER

JAMAICA & LONDONDERRY, VERMONT

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Preface

The purpose of this Environmental Assessment is to provide the basis for evaluation of the environmental impact on the project area due to the routine operation and maintenance of this flood control reservoir. Ball Mountain Lake has been operated whenever necessary since it was constructed to prevent or reduce downstream flooding. Maintenance and management of the project, including the recreation facilities, during non-flood periods is also of primary importance. Enhancement of the fish and wildlife resources as well as protection of the environment within and around the reservoir area has been given careful consideration.

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I. PROJECT DESCRIPTION

A. INTRODUCTION

1. Location and Authorization

Ball Mountain Lake, completed in October 1961, is located in southeastern Vermont on the West River in the towns of Jamaica and Londonderry, Windsor County. The project is about 29 miles upstream of the confluence of the West and Connecticut Rivers.

Authorization for the project is contained in the Flood Control Act of 1938 (Public Law 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 1941 (Public Law 228, 77th Congress, 1st Session) and the Flood Control Act of 1944 (Public Law 534, 78th Congress, 2nd Session). Authorization for development and use of reservoir areas for public recreational and other purposes is also contained in the Flood Control Act of 1944, Section 4.

2. Purpose

The existing flood control plan for the West River watershed consists of Ball Mountain and Townshend Lakes and one local protection project at Weston, Vermont. Ball Mountain Lake is operated in conjunction with Townshend Lake, 9.5 miles downstream, primarily to desynchronize flood flows of the West River from flood flows of the Connecticut River. The operation of the two dams is coordinated with other dams in the Connecticut River basin to obtain maximum reduction in overall flood damages. They also provide protection to downstream West River communities and offer water-based recreational opportunities.

Since its construction in 1961, at a cost of $10,585,000, through 1972, Ball Mountain Lake has prevented an estimated $1.3 million in damages, and, in a recurrence of the March 1936 record Connecticut River flood under 1972 conditions, would prevent damages estimated at $12,550,000.

B. STRUCTURES AND RESERVOIR

1. Dam

Ball Mountain Dam is a rolled earth and rockfill embankment 915 feet long with a maximum height of 265 feet. The top of the dam at elevation 1,052 feet mean sea level (msl) is 20 feet wide and provides for 30 feet of surcharge and 5 feet of freeboard.

2. Spillway

The chute spillway is located on the south abutment adjacent to the dam. The spillway is an uncontrolled ogee weir with a fixed crest elevation at 1,017 feet msl and a length of 235 feet. The spillway approach channel is about 450 feet long. The spillway discharge channel varies in bottom width from 228 feet at the toe of the spillway to 100 feet about 375 feet downstream.

3. Outlet Works

The outlet works consist mainly of an intake tower, a conduit, and an outlet channel. The intake tower houses the equipment necessary to operate the three 5'8" x 10'0" hydraulic slide gates that control the flow in the conduit. The concrete circular tunnel conduit through the dam has a diameter of 13' 6" and a length of 864 feet. The outlet works flare to the outlet channel which has a bottom width of 32 feet and empties into the West River.

4. Reservoir

A small permanent pool is maintained at Ball Mountain Dam to facilitate gate operations during the winter months. This 20-acre pool at about elevation 830 feet msl has a water depth of 25 feet at the dam and about 240 acre-feet of storage. A conservation pool at about elevation 870 feet msl is maintained during the summer. It has a maximum depth of 65 feet, an area of 75 acres, and utilizes a net storage of 2,000 acre-feet. During the late fall, winter, and spring months there is a net storage of 54,450 acre-feet set aside for flood control purposes, which is equivalent to 5.90 inches of runoff from the 172-square mile drainage area. During the recreation season, the net storage is reduced to 52,450 acre-feet, equivalent to 5.70 inches of runoff. The reservoir, when filled to spillway crest elevation, 1,017 feet msl, has a total capacity of 54,690 acre-feet, a surface area of 810 acres, and a length of 6.5 miles.

5. Real Estate

Ball Mountain Lake contains 965 acres of land acquired in fee below an approximate elevation of 985 feet msl. Flowage easements have been obtained on another 262 acres between elevations 985 feet msl and 1,057 feet msl, yielding a total project area of 1,227 acres.

C. OPERATION PROCEDURES

1. Normal Operation

At Ball Mountain Lake, a winter pool is maintained at a stage of about 25 feet to submerge the flood control gates. During May and following the spring snowmelt period, the lake is raised to a stage of 65 feet and

this depth is generally maintained for recreation purposes throughout the warm months, unless flood regulation becomes necessary. The lake may be raised to 70 feet for canoe races in the spring if requested by the American Canoe Association. Flow is restricted after the races to refill the conservation lake. Similarly, the autumn drawdown of the conservation lake may take place during the Columbus Day weekend in October to assist white water canoeists if so requested.

2. Flood Periods

Operations at Ball Mountain and Townshend Lakes are closely coordinated for maximum flood control efficiency. Regulation of flows from the lakes is initiated for heavy rainfall occurring over the West River watershed and also for specific river stages at West and Connecticut River index stations. Regulation may be considered in three phases during the course of a flood, and these are described briefly below.

a. Phase I - Initial Regulation of Discharge

This phase is important as it is necessary to collect rainfall and discharge data in order to appraise the development and magnitude of a flood for the basin. Gate operations at Ball Mountain and Townshend will be initiated for the following conditions:

(1) Rainfall. Depending on antecedent conditions, past experience has indicated that 2 to 3 inches of rainfall over the West River basin in 24 hours will produce a moderate rise in river stages. Therefore, initial regulation of the reservoirs is necessary whenever the following rainfall has been recorded at either dam within a 24-hour period.

Rainfall - Inches	Maximum Permissible Discharge Ball Mountain (cfs)	Townshend (cfs)
Less than 2	Maintain stable pool	Maintain stable pool
2 to 3	2,000	3,000
3 to 4	1,000	1,500
More than 4	(Min. opening)	(Min. opening)

(2) West River stages. Ball Mountain and Townshend Lake outflows will be restricted as necessary to maintain safe channel capacities on the West River. High river stages would be produced by runoff from rainfall, snowmelt or a combination thereof. Safe channel capacities are as follows:

Location	Safe Channel Capacity (cfs)	Stage at (feet)
Ball Mountain to Townshend	5,000	Jamaica 9.0
Townshend to Newfane	9,000	Newfane 9.6

In addition, flood regulation at the projects is dependent upon storing and releasing water in such a manner as to desynchronize West River flows from those in the Connecticut River. The regulation and its timing vary with conditions on the Connecticut River and with the season as well, since the beginning damage stages are lower during the growing season than in nongrowing periods.

b. Phase II - Continuation of Regulation

An important regulation activity during this period is the collection of hydrologic data such as: (1) precipitation amounts throughout the entire watershed as well as surrounding areas; (2) snow cover and water content in case of spring floods; (3) stage and discharge

values at downstream control points; (4) other pertinent data which would assist in the regulation. During this phase, the reservoir discharge is also regulated to reduce downstream flooding on the Connecticut River.

c. Phase III - Emptying the Reservoirs

Following a flood, the reservoir is emptied as rapidly as possible. Stored floodwaters will be released in accordance with instructions issued by the Reservoir Control Center (RCC). In general, releases will be based upon conditions on the Connecticut River and the amount of storage utilized in both reservoirs and other reservoirs in the system. The maximum rate of reservoir drawdown should not exceed about 10 feet at Townshend and 20 feet at Ball Mountain in 24 hours. The rate of increase in reservoir discharge during the emptying period is not to exceed the following:

Ball Mountain Lake - 1,000 cfs per hour until discharge reaches 4,000 cfs and 500 cfs per hour between 4,000 to 5,000 cfs.

Townshend Lake - 1,000 cfs per hour until discharge reaches 7,000 cfs and 500 cfs per hour between 7,000 to 9,000 cfs.

Evacuation discharges from the reservoirs will not exceed West River channel capacities except as directed by the RCC under unusual conditions. The discharge to be released from Townshend Lake depends primarily on the stage at Newfane and is restricted to the channel capacity of 9,000 cfs. The discharge from Ball Mountain Lake shall not exceed 5,000 cfs. In general, outflow from Ball Mountain will be regulated so that the available flood control storage is approximately the same at both reservoirs.

Evacuation of the lakes will not be initiated until the flood crest has passed Montague City, Massachusetts, to avoid contributing to flood conditions on the main stem of the Connecticut River. Secondary river rises during Phase III may result in the regulation procedures reverting to Phase II.

d. Emergency Operation Poocedures

In the event that communication is lost between the project manager and the RCC, conservative regulation procedures are initiated, depending on precipitation and river stage conditions. The project manager is not to begin emptying the reservoir until contact is re-established with the RCC and instructions given.

3. Cooperation with Downstream Water Users

It is the policy of the Corps of Engineers to cooperate whenever possible with downstream users and other interested parties or agencies. The project manager may be requested by downstream users to deviate from normal regulations for short periods of time. Whenever such a request is received, the manager shall ascertain the validity of the request, obtain assurance from other downstream water users that they are agreeable to the proposed operation, and request instructions from the RCC. Under no circumstances will the reservoir release be less than about 25 cfs since this outflow is required for downstream fish life.

D. MANAGEMENT PROGRAMS

The New England Division, Corps of Engineers, manages an area near the confluence of the Winhall and West Rivers for day-use recreation and tent camping. Although Vermont's Fish and Game Department annually stocks trout in several streams in the upper West River watershed, there is no formal management of the fish and game resources within the reservoir by either the Corps or the State of Vermont.

II. ENVIRONMENTAL SETTING

A. DESCRIPTION OF GENERAL AREA

1. Climate and Precipitation

The West River watershed has a variable climate characterized by frequent but generally short periods of heavy rainfall in the summer and longer periods of less intense precipitation in the winter months. It lies in the path of the prevailing westerlies and continental storms that move across the country from the west or southwest. The area is also exposed to Atlantic coastal storms, locally known as "northeasters." In addition, tropical hurricanes constitute an infrequent but important potential for flood-producing precipitation, particularly from July to October. Thunderstorms may occur over the basin during most months of the year and may be of local origin or associated with a stationary front.

Southern Vermont generally experiences long, cold winters and relatively mild summers. Freezing temperatures can be expected from late September to early May, and the mean length of the frost-free season in the vicinity of Ball Mountain Lake is about 110 days. Average annual temperatures in the watershed vary from about 40°F. in the mountainous regions to about

45°F. in the valleys at lower elevations. Summer temperatures occasionally reach the high 90's and minimum winter temperatures near -40°F. have been recorded in the watershed.

Although precipitation is rather uniformly distributed throughout the year, the tendency to greater precipitation with increased elevation is very marked. The average annual precipitation at Townshend Dam (elevation 800 feet msl) is about 41.5 inches, whereas at Somerset, Vermont (elevation 2,080 feet msl), the annual average is 51.5 inches. The mean annual runoff in the West River watershed represents about 60 percent of the mean annual precipitation, with over half of the runoff occurring in March, April and May.

2. Topography

The West River watershed, located in southern Vermont within Windham, Bennington, Rutland and Windsor counties, is generally elongated with a northwest-southeast axis, a length of about 38 miles and a maximum width of 18 miles. From the mouth of the West River to Ball Mountain Lake, the watershed is hilly with steep wooded slopes and has little well defined flood plain area. Upstream of Ball Mountain Lake, the terrain is mountainous. Elevations vary from 220 feet msl at the river mouth to 3500 feet at several points on the watershed divide. The West River and its tributaries all have relatively steep gradients conducive to the rapid discharge of runoff. In the sixteen miles between the upstream end of Ball Mountain Lake and the outlet of Townshend Dam, the river falls some 560 feet, or an average of 35 feet per mile.

Ball Mountain Dam is situated in a narrow valley flanked by Shatterack Mountain to the north and Ball Mountain to the south, having elevations of 1960 feet msl and 1771 feet msl, respectively.

3. Vegetative Cover Types

Ball Mountain Lake lies in a forest vegetation zone characterized by American beech, yellow birch and sugar maple, often called northern hardwoods. Commonly associated species are hemlock and white pine. In the cooler Green Mountain areas of the upper watershed, forests consist mainly of the red, white and black spruces and balsam fir. Timber harvesting, forest fires, soil conditions, and other natural and man-induced factors have altered these patterns locally, but the general regions are still readily distinguishable.

4. Fish and Wildlife Species Present

Game fish found in the West River watershed include brook and brown trout, smallmouth bass, limited numbers of largemouth bass and chain pickerel. Walleyed pike are present in the lower West River below Townshend Dam, and "panfish" such as the bluegill and common sunfish, rock bass, yellow perch, and brown bullhead are common to the streams and ponds in the drainage area. Other species are the longnose and common sucker, darter, sculpin, black-nosed and long-nosed dace, fallfish, creek chub, golden shiner, one or more species of killifish (Fundulus spp.), and carp (in the lower river). Vermont Fish and Game personnel have found common eels in the West River as far upstream as Weston. The eel is a catadromous species, meaning it lives in fresh water and returns to the ocean to spawn. In some manner, then, the species has been able to pass several dams on the main stem Connecticut River as well as Ball Mountain and Townshend Dams on the West River.

The southern portion of Vermont supports an abundant white-tailed deer population. Some black bears inhabit the region as well. Cottontail rabbits, snowshoe hares, raccoons, red and gray foxes, ruffed grouse, and woodcock are all found in the vicinity of the reservoir. Furbearers include beaver, muskrat, and mink, but better habitat for these animals is found on tributary streams. It is possible that some rare or endangered species, especially birds, inhabit or frequent the project area, although a detailed survey would be required to ascertain their presence.

5. Geological Features

The valley of the West River originally was eroded in its present southeasterly direction through the relatively thin series of Comanchean and Cretaceous deposits that overlaid the harder, stronger rocks of the Fall Line Peneplain. Most of the valley near the reservoir is characterized by kame terraces and outwash deposits left by glacial melt waters, while the steeper glaciated terrain exhibits many large outcroppings of bedrock with some sheer cliffs near the tops of surrounding hills.

The soils of this region are glacial in origin and belong to the Gray- Brown Podzolic group. The soils on the more level sites are Gloucester and Shelby loam. Other than sand and gravel deposits, no important mineral resources are known to exist in the area.

6. Socioecomomic Conditions

Windham County, in which Ball Mountain Lake is located, experienced a population increase of 11.1 percent in the 1960-1970 decade, due in part to the increased demand for rural living and recreation. Much of the

growth has been associated with ski area development, second homes, and the movement of people out of metropolitan areas in Massachusetts and Connecticut.

The paper and printing industries, along with lumber and wood products, form the major base for economic activity in the West River watershed. Recent developments of various small manufacturing plants, particularly near Brattleboro at the confluence of the West and Connecticut Rivers, have increased employment opportunities and the economic diversity in the area.

Winter recreation also represents an important part of the economy in Windham County and the West River watershed. Within a 15-mile radius of Jamaica, located on the West River between Ball Mountain and Townshend Lakes, there are nine ski areas, and winter service employment in the county is often 30 percent higher than the annual average to accommodate the skiers and other winter sports enthusiasts.

The West River watershed supports some dairy farming, sheep raising, and other agricultural activities, but agriculture is not as important in this area as in other parts of the State. Apples are an important crop in the area, and there has been a considerable effort to replant orchards and increase production throughout the State of Vermont.

Vermont Route 30 parallels the West River from Brattleboro and provides access to both Ball Mountain and Townshend Lakes. Travelers from northern Vermont, western Massachusetts and Connecticut can utilize Interstate Route 91 which generally follows the Connecticut River for most of its length and connects to Route 30 in Brattleboro.

III. ENVIRONMENTAL IMPACT OF THE OPERATION, MAINTENANCE, AND MANAGEMENT PROGRAM

A. OPERATION FOR AUTHORIZED PURPOSES

1. Downstream Effects - Regulation of Flows and Releases

a. Flooding Prevented

Ball Mountain and Townshend Lakes are operated as a unit to reduce flood stages on the West River and desynchronize West River contributions to peak flows on the Connecticut River. Ball Mountain Lake has reached a stage of 98.0 feet or more, representing 10 percent of the total flood storage capacity, seventeen times since beginning operations in 1961. The narrow valley and steep gradient of the West River along its entire length have basically precluded large scale development of the limited flood-prone areas. At Jamaica, between Ball Mountain and Townshend Lakes, a trailer park situated immediately adjacent to the river has experienced ice jam floods in the past. Minor channel improvements were conducted in 1969 and neither this nor any other areas produce significant operating constraints for the two West River flood control reservoirs.

During the last four days of June 1973 a significant flood developed in much of the Connecticut River Basin. In the West River watershed the storm rainfall totaled more than 8 inches. The shower activity was sometimes torrential in nature with reported amounts of 4 to 5 inches in a six hour period. An estimated peak inflow of 31,000 cfs into Ball Mountain Lake was observed on 30 June 1973. The flood was noteworthy from several aspects: torrential rainfall, rapid rates of runoff, and occurrence during the summer growing season. The

reservoir filled to a depth of 178 feet which is equivalent to 59% of capacity.

Ball Mountain Lake has prevented damages estimated at $1.3 million since construction and would, under 1972 conditions, prevent dollar damages of $12,550,000 in a recurrence of the March 1936 record Connecticut River flood, as determined by the Corps of Engineers from stage-damage relationships and other flood plain studies.

b. Water Quality

Personnel from the Corps' Water Quality Laboratory routinely collect water quality data from four sampling stations at Ball Mountain Lake during the period from late spring or early summer through late fall or early winter. Data compiled by the laboratory includes periodic (approximately monthly) measurements of air and water temperature, turbidity, conductivity, dissolved oxygen and pH, plus occasional grab samples for a variety of other chemical and biological constituents. Available results from 1971, indicate that discharge water temperatures, measured near the U. S. G. S. gaging station about 2.8 miles downstream of Ball Mountain Dam, were slightly lower than the corresponding West River inflow temperatures during the summer months. Data collected in the summers of 1972 and 1973 indicated that outflow temperatures were only occasionally higher than inflow temperatures. This slight difference could be attributable to the release of the colder water from the bottom of the 65-foot deep conservation lake. Although trout are not abundant in the project area and the West River between Townshend and Ball Mountain Lakes is stocked frequently, the maintenance of cooler stream temperatures for most of the summer might enhance the potential for a put-and-take fishery and improve the carry-over capacity for cold water species.

The conservation pool does not appear to have a significant effect on dissolved oxygen levels downstream of the dam, as the lowest recorded value at the discharge station for the three-year period was 6.6 mg/l on July 24, 1972, while one inflow station measured 6.0 on the same date.

Turbidity and conductivity measurements show no significant differences between the inflow and discharge stations. A lack of data in the spring when most flood control operations have taken place makes a judgment of the effects of temporary impoundment on water quality difficult. The Corps did conduct a water quality survey at Ball Mountain Lake on 11 July 1973, just after the flood pool (maximum stage 177.8 feet) had been drawn down to the conservation lake level and flows in the West River had returned to normal. Recorded turbidity at the discharge station, although still low (5.2 Jackson turbidity units - Jtu), was almost twice as high as that at the West River inflow station (2.7 Jtu) and almost six times that at the Winhall River station a short distance above the confluence of Winhall Brook (0.9 Jtu). However, measurements taken in August and September of 1973 at the discharge station were even higher than the July reading.

This moderate increase in turbidity was probably due to the release of sediments which had concentrated in the lower zones of the conservation lake subsequent to flood storage. It is likely that brief increases in downstream turbidity occurred after other flood control operations, since there is no weir control of pool levels at Ball Mountain Lake. These small increases in turbidity caused by flooding and reservoir operations had little effect on the aquatic environment and are not cause for special concern.

c. Recreational Use

The West River Canoeing Committee, with the support of several state and town agencies and officials, requested that flow regulation at Ball Mountain Lake be incorporated into the project's Master Plan and operating policies. The provision of adequate flows for canoe racing was found to be compatible with authorized flood control objectives, and regulation for this purpose has taken place annually since 1962.

During the month of May and after the spring snowmelt period, the conservation lake is refilled to the normal recreation stage of 65 feet. At this time, the lake may be raised to a stage of 70 feet to provide about 2500 acre-feet of storage for augmenting West River flows for white water canoe races, if requested by the American Canoe Association. Optimum flow for the races is in the range of 1,200-2,000 cfs. Following drawdown for the races, flows are restricted to refill the conservation lake. Similarly, in the fall, the lake is lowered to the 25-foot winter level and the drawdown may take place during Columbus Day weekend in October to assist white water canoeists, again upon request by the American Canoe Association.

The capability to regulate flows at Ball Mountain Lake removes the dependence on natural runoff conditions to meet the needs of white water canoeists, and also facilitates planning for race events since satisfactory flows in the West River can be assured. These water based recreational benefits are important to a growing number of canoeists and kayakers.

2. Upstream Effects in Reservoir

a. Fish and Wildlife

Water level fluctuations in Ball Mountain Reservoir are extreme, with variations of 75 feet or more occurring almost every year. About 2.8 miles of the West River above Ball Mountain Dam are thus subjected to periodic inundation from flood control operations and about 1.8 miles from the summer conservation lake. Although the Vermont Fish and Game Department has indicated that the West River fishery is not highly productive, regular flooding is disruptive to the stream environment in the reservoir and adversely affects fish reproduction and growth. In addition, the winter drawdown of the conservation lake inhibits the establishment of a warm water lake fishery. The winter pool would be too small to hold a significant population of fish through the drawdown period if management of the resource were attempted. Also detracting from the potential for a successful warm water sport fishery is the accumulation of sediments on the pool bottom. Alternating exposure and inundation of the shoreline effectively retards the growth of rooted aquatic vegetation which, along with the absence of extensive shallow areas and possible flooding, limits suitable spawning habitat for various fish species.

Small game and nongame wildlife are detrimentally affected by impoundments in the reservoir and may suffer some direct losses by drowning. The changes in vegetation and habitat induced by periodic inundation, however, have a greater influence on wildlife. Some herbaceous and understory species comprising food and cover for animals have been

killed or damaged by flooding and at the lower elevations, the average time between successive reservoir operations is insufficient to permit significant regrowth of small plants. The reduction of desirable wildlife habitat and game species may somewhat detract from potential use of the project by hunters.

b. Vegetative Cover and Timber

Water may be impounded to a depth of more than 210 feet in the steep, narrow reservoir created by Ball Mountain Dam. Much of the reservoir is forested with very little level or gently sloping terrain except immediately adjacent to the West River. About 75 acres of forest land between stages of 65 feet (summer conservation lake level) and 100 feet have been flooded more than once a year, on the average, and to a depth of 80 feet during the June-July 1973 flood. It is probable that the depth of flooding, particularly during the summer growing season, accentuates some permanent tree and vegetation damage since the likelihood of most trees surviving even relatively short periods of total inundation is much less than if the same trees were only partially submerged. Observations show that the June-July 1973 storage operation caused significant tree mortality and other vegetation damage in the flooded portions of the reservoir.

The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) has conducted a study for the Corps of Engineers to determine damage at Ball Mountain Reservoir and several other Corps reservoirs in New Hampshire and Vermont, utilizing aerial photography and infrared imagery techniques. Preliminary estimates show several zones of tree

and vegetation damage. A detailed report will be available in early 1975.

Generally, coniferous trees are more susceptible to damage from flooding than are deciduous species. Balsam fir, hemlock and other conifers with closely spaced needles also tend to catch and hold silt left by a receding flood pool. Even six months after the summer 1973 flood control operations, many of the short-needled evergreens observed along the road following the West River were still encrusted with silt. Several balsam firs completely inundated in the summer were found to have green needles on about half the branches, but were not covered with silt, suggesting that some conifers may be able to survive moderate durations of flooding if left relatively clean after pool drawdown.

It was also noted that many trees in the flooded portions of the reservoir, particularly yellow birch, white pine, red spruce and balsam fir, were hosts to a variety of parasites such as liverworts, rusts and larger fungi, attacking both the trunks and small branches. It appears that flooding during the summer of 1973 may have stimulated the growth of these plants by contributing to the necessary moist conditions in the reservoir, since observations in December 1973 showed such growth to be more prolific in flooded portions. In any case, diseased trees will exhibit weakened resistance to future flooding and the combination of natural forces and reservoir operations will undoubtedly result in further tree losses throughout the project life.

c. Recreational Use

The Winhall Recreation Area is not affected by stored floodwaters until the pool reaches a stage of about 136 feet, or about 28 percent of capacity. After a storage operation of this magnitude or greater, the recreation area usually has to be closed to allow for cleanup of debris and repair of damaged picnic tables and fireplaces. Also, access roads may be blocked by debris and must be cleared.

The remainder of the project has no developed recreational facilities. Since vehicle access to the lower reservoir is limited, it is improbable that temporary inundation would result in a significant loss of recreational opportunity for the small number of people who might hike or fish in the area. The value of the project lands for hunting has also been impaired to a limited extent by flood control operations.

d. Aesthetics

The conservation lake is drawn down in the fall to regain adequate flood control storage for the spring runoff. Fifty acres of shoreline therefore are exposed from mid-October until spring, except during any flood control operations. The area normally exposed was cleared in 1967 before filling the summer lake and remains devoid of vegetation. Winter visitation and use of the reservoir is low, however, and the poor appearance of the reservoir, when not under snow cover, is less important than it would be in the summer.

The flood of June-July 1973 left considerable amounts of debris and silt in the affected portions of the reservoir. Tree mortality also appears to have been heavy in areas where vegetation was completely submerged for any significant amount of time. There are no ready solutions to the aesthetic impacts of operating the reservoir for flood control, as too much land area is involved to justify any extensive cleanup efforts other than at the developed recreation areas.

B. CONSTRUCTION AND MAINTENANCE OF PROJECT FACILITIES

1. Recreational Facilities

Facilities at the Winhall Recreation Area include 28 wood picnic tables, 19 fireplaces, drinking water supply, a small beach area, and a comfort station with chemical toilets. A new flush type comfort station is scheduled to be constructed in the spring of 1975. Large open fields on both sides of the Winhall River, near its confluence with the West River, have been heavily used in the past by both tent and trailer campers. The area is well suited for the types of recreation already developed and provides space for expansion of facilities as the need arises. Because of the small scale of initial development and the presence of adequate land, very little clearing has been necessary to install tables, fireplaces, and campsites.

2. Sewage and Solid Waste Disposal

It is mandatory that the holding tank of the chemical comfort station be cleaned or pumped out at the end of each recreation season and as necessary during the summer. This practice eliminates a potential source of pollution except if the building is unexpectedly flooded

while sewage is being held in the vault. As discussed in Section III.C below, there is a need for an additional comfort station on the north side of the Winhall River to accommodate users of that area.

3. Vegetation Control

The project manager is instructed to inspect all reservoir grounds annually, as well as after flood storage operations, to determine the need for brush trimming, mowing, seeding, and other vegetation maintenance measures. The open fields at the Winhall Recreation Area are mowed as required to keep a suitable appearance for recreational users. Several small erosion problems also require periodic maintenance.

Dead and fallen trees cannot practically and economically be removed from the reservoir on a large scale. Maintenance work focuses on keeping access roads, culverts, and the log boom area free of debris. Each flood control operation adds to the problem as more dead trees and debris float downstream to the dam. Although it is economically infeasible to remove all snags, broken limbs, and partially fallen trees, they can be a problem and are removed periodically in the most frequently visited areas.

C. MANAGEMENT OF PROJECT LANDS

1. Rules and Regulations

The main objective of rules and regulations at project lands and waters managed by the Corps is to provide for the health and safety of the visiting public. Negative signs and warnings have been held to a minimum so that the public may enjoy the greatest freedom without unnecessary restraint. At the Winhall Recreation Area, use of trail

bikes and minibikes in the vicinity of the camping and picnicking sites is prohibited. Besides the obvious noise problem, such vehicles would present a potential safety hazard in the public use area and could be damaging to soil and small vegetation. The remainder of the project is open to all recreational vehicles.

2. Recreational Use and Management

Visitation at the Winhall Recreation Area averaged fewer than 2,000 persons annually prior to 1969 and then showed a steady increase to more than 17,000 in 1972. Recreational use fell to about 6,000 in 1973 due to the major flood control operation in early summer which necessitated considerable maintenance work in the area. Recently, both tent and trailer camping have become popular with an estimated 13,000 campers using the Winhall area in 1972.

The lack of a comfort station on the north side of the Winhall River is an inconvenience to campers using the area. Although development of campsites in the area has not been fully completed, camping use is sufficient to justify provision of sanitary facilities. Visitation and use of the recreation area have not produced any particular management problems. The damage to trees and other vegetation, evidenced in some parts of the Winhall Recreation Area, is due to inundation from flood storage operations and natural causes rather than abuse by recreationists.

IV. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AS A RESULT OF THE OPERATION AND MAINTENANCE PROGRAM

A. FISH AND WILDLIFE

Periodic filling of Ball Mountain Reservoir unavoidably alters the natural stream environment of the West River with some adverse impacts on the stream fishery. Also, the seasonal conservation lake is not well suited to support a warm water lake fishery because of excessive water level changes. Large fluctuations accompany not only flood storage and release operations, but also the drawdown of the conservation lake in the fall, its refilling in late spring, and the release and impoundment associated with regulation for white water canoeing. These operations may interrupt fish and aquatic vegetation growth necessary for maintaining a reasonably good fishery resource in the lake.

Detrimental effects on wildlife from reservoir flooding include occasional drowning of small game and nongame animals, particularly the young of nesting or burrowing species, temporary loss of habitat, and damage to grasses, shrubs and trees which are utilized for food and cover.

B. WATER QUALITY

Whenever a flood pool or the summer conservation pool is drawn down at Ball Mountain Lake, temporary increases in turbidity downstream from the dam result. Available water quality data for the project area does not reveal any other detrimental effects on water quality resulting from authorized operation of Ball Mountain Lake.

C. VEGETATIVE COVER AND TIMBER

Major flood control operations are not limited to the spring runoff period and may occur in the peak growing season, as in June-July 1973.

Periodic flooding early in the year before the active growing season sometimes inflicts almost no loss of vegetation in the reservoir, since most trees are dormant during the winter and early spring. In those lower areas where many larger trees have been killed, the time between significant flood control operations will probably be insufficient to allow regrowth of the forest cover to its former state, resulting in maintenance of the early stages of forest development and succession. Tree and vegetation damage from inundation and siltation in the reservoir is inevitable, and the severity depends basically on the time of year, the extent and duration of flooding, and the frequency of recurrence.

D. BANK EROSION

The West and Winhall River valleys within the reservoir are, for the most part, steep and forested, with only isolated erosion problems attributable to flood control operations. However, banks in some areas may become susceptible to erosion where trees and other vegetation have been killed by flooding. Potential problem locations are near several gullies which convey hillside runoff into the reservoir , and access road embankments. Existing roads in the reservoir occasionally require maintenance and repair because of washouts after inundation.

V. ALTERNATIVES TO THE OPERATION, MAINTENANCE, AND MANAGEMENT PROGRAM

A. DISCONTINUANCE OF AUTHORIZED FLOOD CONTROL OPERATION

As the most recent flood of June-July 1973 showed, serious losses, often agricultural in nature, still occur in many places despite the protection afforded by existing flood control reservoirs in the Connecticut River Basin. Even the institution of flood plain zoning, regulation, and other nonstructural measures throughout the basin will have relatively little effect on present flood damage conditions. Further, because several proposed reservoirs in the Connecticut River Basin flood control program have not yet been and may never be constructed, the continued operation of Ball Mountain Lake is essential in maintaining the existing level of protection on the West and Connecticut Rivers.

B. LAND MANAGEMENT ALTERNATIVES

1. Discontinuance of Land Management Activities

Ball Mountain Lake is presently managed for day-use recreation and family camping. Demand for these activities has increased steadily in recent years, as has visitation at the recreation area. Without management plans, public use of the project area would undoubtedly decline. General control and surveillance of the reservoir area are important management responsibilities at Ball Mountain Lake. As noted by project personnel, a considerable number of campers had used the Winhall River area even before its designation and layout for that purpose. Rather than denying the public access altogether, provision of adequate facilities to accommodate the basic needs of visitors, especially sanitary

and solid waste disposal, is critical to protecting and gaining maximum recreational benefits from the project's environmental resources.

2. Single Purpose Versus Multiple Use Management

Camping and day-use recreation are the only uses of the reservoir for which specific management is carried out. However, fishermen, hikers, hunters and snowmobilers all benefit from the maintenance of access roads and from the general availability of public land at the project.

The summer conservation lake, maintained at a stage of about 65 feet from May to October, has not appreciably enhanced fish and wildlife values at the project; its major benefit is aesthetic since boating and fishing uses are minimal. Although the Vermont Fish and Game Department to date has not expressed interest in managing the Ball Mountain project area for either fish or wildlife improvement, limited opportunities for enhancing these resources do exist and may be reconsidered in the future as demands increase.

Because of limitations imposed by topography and recurrent flooding, much of the reservoir area is not amenable to intensive recreational use and management. However, greater use could be made of the project area with the addition of limited facilities near the lake should public use at the Winhall Recreation Area increase to a point where further expansion would entail reduction of aesthetic and environmental values. Development of the West River Recreation Area, as contemplated in the old Master Plan, has been precluded since creation of the summer lake, but several other sites could be opened for day-use activities or "primitive" tent camping. New vehicle access would not be necessary since the old

road and railroad bed along the West River would suffice for low-density recreation. Due to frequent inundation, park-type facilities would require substantial care, suggesting that minimal development with designated areas for camping be provided.

C. CONSTRUCTION AND MAINTENANCE ALTERNATIVES

1. Sewage and Solid Waste Disposal

There exists a need for sanitary facilities at the camping area at the confluence of the Winhall and West Rivers. The comfort station at the day-use area is flooded occasionally. Therefore, installation of a subsurface disposal system using a septic tank and leaching field would be preferable to the present chemical toilets, which are a potential water pollution hazard.

2. Subimpoundment for Swimming

Consideration may be given to the construction of a permanent weir at the Winhall Recreation Area for maintaining a small swimming pool and beach. The past arrangement for bulldozing a temporary dam, periodically destroyed by flooding or high river flows, is unsatisfactory and necessitates frequent maintenance. A possible alternative would be to construct a permanent concrete weir. A permanent impoundment at the recreation area would eliminate the recurring environmental problems associated with frequent construction and maintenance of a short-lived gravel embankment.

D. WATER LEVEL MANAGEMENT

A 75-acre conservation lake is maintained at Ball Mountain Lake from May through October, and a 20 acre permanent pool is held during the winter season to protect the flood control gates from icing. The large differences in both depth and area between the two pools prevent the maintenance of a lake environment which is suitable for warm water fish species. Due to flood control storage requirements, keeping the pool at the summer level all year is not possible. However, certain advantages could result from raising the winter pool to a level somewhat higher than the present 25-foot stage but below the summer elevation. If, for example, the winter pool were held at a stage of 40 feet rather than 25 feet, water level fluctuations would be less for a given increase in storage volume. Also, an area of 41 acres would be permanently under water; a pool of this size would create a better habitat for warm water fish and improve conditions for survival during the winter months. This method of management would be particularly important if the Vermont Fish and Game Department chose to manage the lake in the future. A higher winter pool would not adversely affect the wildlife resources of the project, as the land below the summer lake level has little value as wildlife habitat.

The enlargement of the winter pool surface area would help to enhance the lake fishery at the project, presently hampered by excessive seasonal drawdown and refilling which take place.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

A. SOCIOECONOMIC EFFECTS

1. Flood Control Benefits

The Connecticut River Basin has a long history of flooding and, in spite of the completion of sixteen flood control reservoirs and sixteen local protection projects, potential damages continue to increase and substantial losses still occur annually. The increase in damages is attributable to both more intensive use of existing industrial plants and new construction on flood plain areas, especially in the lower basin. The Connecticut River Basin Coordinating Committee, in its nine-volume comprehensive report, estimated that recurring losses along the main stem Connecticut River increased 21.4 percent during the period from 1952 to 1968. Nevertheless, coordinated operation of the reservoir system, including Ball Mountain and Townshend Lakes on the West River, has prevented $1.3 million worth of damages.

In light of more intensive investigation of various flood control and management alternatives now being conducted for the Connecticut River Basin, and greater exercise of local options for flood plain management, the upward trend of damages may be slowed in the future. Such policies would balance economic growth in flood-prone areas with the reasonable degree of flood protection which flood control reservoirs on upstream tributaries can afford, and would help to maintain the ecological and aesthetic values of river lowlands.

2. Recreational Benefits

Ball Mountain Lake represents an important recreational resource in southern Vermont, and is readily accessible to both Vermont residents and out-of-state visitors including the more heavily populated metropolitan areas of Massachusetts and Connecticut. Experience at other public recreation areas has shown that marked increases in visitation usually accompany the addition of new facilities, with little or no effect on attendance at surrounding recreation areas.

For long range planning, it must be realized that, although significant public use is practically guaranteed for any recreational development which is implemented, the natural resources of the project have finite capability for accommodating recreational use without damage to the environment. Furthermore, public priorities and wants with respect to recreation are gradually changing. Additional allowances must be made for anticipating these changes if, for example, preservation of the natural landscape and wilderness areas is deemed more important than committing project lands to intensive recreational development. The Winhall Recreation Area will continue to be the central point for camping and day-use recreation as topography, accessibility, and existing vegetation are well suited for these uses. The remainder of the reservoir area lacks features which are conducive to intensive use, thus favoring maintenance of its natural state.

B. BIOLOGICAL COMMUNITIES AND ECOSYSTEMS

Generally, alteration of the natural patterns of stream flow has no long-lasting impacts on fish, wildlife, or vegetation downstream in the West River. Runoff from uncontrolled drainage areas below the project on both the West and Connecticut Rivers further masks the temporary flow deficiencies created by reduction and delay of peak discharges. The coordinated operation of the reservoirs in the Connecticut River Basin can reduce or prevent damaging inundation of both agricultural and developed urban lands on the flood plain. The protection of crops and crop lands affords obvious short-term benefits to farmers whose fields are subject to flooding. However, the long-term productivity of this land, normally dependent on periodic deposition of rich topsoil by flooding, may in fact be lessened as this flooding is reduced. In the absence of stringent flood plain land use controls, more and more agricultural land has also been forced out of production to be used for industrial and commercial purposes, thus trading vegetative land use for more economic development. Many forms of development are beginning to be viewed as incompatible uses of flood plains, so that natural biological communities on river lowlands may be afforded better protection and preservation in the future.

VII. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH ARE INVOLVED IN THE OPERATION AND MAINTENANCE PROGRAM

A. LOSS OF NATURAL RESOURCES DUE TO PERIODIC FLOODING

Tree losses from periodic flooding in the reservoir cannot be recovered as long as project operations continue, since recurring inundatation jeopardizes the survival and growth of seedlings and smaller trees which would succeed tree mortality under normal conditions. About 160 acres of habitat for upland game and nongame species and fur-bearers above the summer conservation lake have been flooded on an average of once every two years and these lower parts of the reservoir now have relatively little value for wildlife. Obviously, the effects of flooding on vegetation and on animal life are inseparable as both are vital to the maintenance of the forest and field ecosystem.

Because neither of the two subimpoundments originally contemplated in the old Master Plan for Reservoir Development was implemented, the project has had a somewhat detrimental influence on the fishery resources of the West and Winhall Rivers upstream of the dam. The seasonal instability of the conservation lake is magnified such that wide variations in water levels over short periods of time accompany even moderate increases in reservoir inflow. Thus benefits from the potential warm water lake fishery and several miles of stream habitat for native and stocked species cannot be fully realized or have been lost through the undesirable effects of flood control operations. These effects include a reduction of the total amount of aquatic forage available for game fish as most stream-dwelling forms cannot survive the change in habitat, disruption of spawning, and siltation in the reservoir.

VIII. COORDINATION WITH OTHER AGENCIES

Coordination with several Federal, State and local interests resulted in valuable input to this assessment. Following is a list of the agencies with whom coordination took place:

Bureau of Sport Fisheries and Wildlife

Vermont State Planning Office

Vermont Agency of Environmental Conservation

Department of Fish and Game

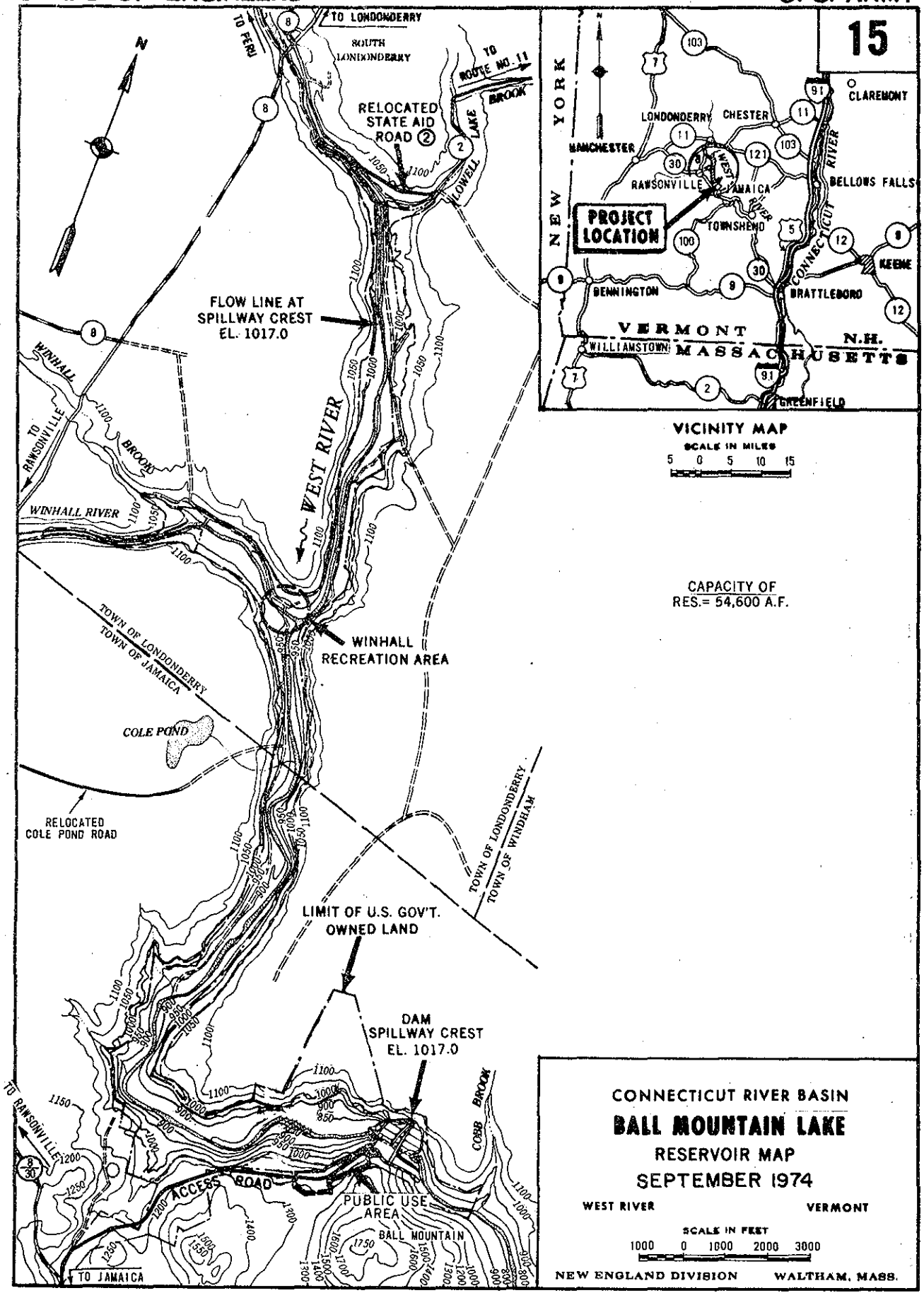
Department of Water Resources

U. S. Army Cold Regions Research and Engineering Laboratory

CORPS OF ENGINEERS

U. S. ARMY

15



VICINITY MAP

SCALE IN MILES

5 0 5 10 15

CAPACITY OF RES.= 54,600 A.F.

CONNECTICUT RIVER BASIN

BALL MOUNTAIN LAKE

RESERVOIR MAP

SEPTEMBER 1974

WEST RIVER VERMONT

SCALE IN FEET

1000 0 1000 2000 3000

NEW ENGLAND DIVISION WALTHAM, MASS.